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GFAP Concentration Associated With Alzheimer's Disease

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ABSTRACT

The condition known as Alzheimer's is a neurological illness that is permanent and causes mental impairment that gets worse with time. It results from an aberrant accumulation of proteins that have been folded incorrectly in the central nervous system, including exterior amyloidosis protein accumulation and internal neurofibrillary tangled proteins.

The prompt identification and forecasting of the pathology in Alzheimer's disorder (AD) patients were the main objective of this investigation. The region of Al-Njaf al-Ashrf's General Hospitals Al Sader General Education served as the investigation's site. Thirty patients with cognitive impairment and twenty standards made up the total of fifty cases that were evaluated. The person in the organization's age varied between 38 to eighty-nine years old around the time of the surgical operation.

According to this particular the research's findings, individuals with AD had a significantly higher Bodyweight (27.79±1.86) than controls. Additionally, findings showed that eighty percent of the respondents had arterial hypertension, forty percent had diabetes, while approximately thirty percent of individuals were smokers within those diagnosed with Alzheimer's. The most recent the research's results demonstrated that, as compared to a healthy group, Alzheimer's patients had insignificant increases ($p<0.05$) in sodium (Na)substantial increases in potassium k levels, and significant decreases in calcium (Ca). Results of the research, however, indicated that patients' levels of (GFAP) were much higher than those of the healthful subgroup.

Conclusions: The elevated ranged of age and body mass index (BMI) in this text are associated with an increased risk of Alzheimer's disease. Additionally, the research advances our knowledge of the anaemia linked to the pathogenesis of Alzheimer. Elevated concentrations of potassium may indicate a potential disruption in ion a state of equilibrium and a correlation has been observed involving fractures and an increased risk of Alzheimer's disease. GFAP, which may prove to be an efficient biomarker for the treatment, prognosis, and assessment of AD development, particularly with regard to brain destruction and memory impairment.

Keywords: *Alzheimer's disease, GFAP, Ca, Na and K.*

1. INTRODUCTION:

among the most widely prevalent forms of cognition is dementia caused by Alzheimer's (1). There is no confirmed cause for AD, which is a progressively heterogeneous degenerative neurological condition. The illness is linked to both modifiable and non-modifiable risk factors. The biggest non-genetic hazards ofallwasaged(2,3).
Dementia is a clinical syndrome characterized by a steady decline in the brain's cerebral activity, making it difficult for the person with the condition to perform everyday tasks.

Alzheimer's disease frequently manifests as memory loss or difficulty finding the correct phrases. Language, thinking, decision-making, visual function, attention to detail, and directional loss of memory are among signs that worsen with time. (4) The predominant hereditary deletion in either the amyloid precursor protein, also known as APP, genes on the 21st chromosome either another among the called presenilin proteins off chromosomal one and fourteen appears to constitute responsible for of the biological aspect of the condition known as Alzheimer's. among furthermore, there is a higher chance of early-onset Alzheimer's among those with recessive disorders (trisomy twenty-one). Despite the fact that AD's genes have become more complicated and poorly understood. It is established that chromosomal 19'person omega 4 genotype of the gene that encodes apolipoprotein E (APOE is a risk associated with the onset of spontaneous Dementia (5)

In an ensemble of Alzheimer's condition (AD) sufferers from al-Njaf al Ashrf, the objective of the research were to foresee and identify the development the dementia earlier , to examine how it relates to the extent about their condition. Furthermore, present research shows a notable disruption underlying ions equilibrium, which may have an effect on the beginnings of AD-related brain impairment.

2. MATERIALS AND METHODS:

This case study was performed through the duration from April to June 2023 in Iraq. The study was conducted in General Hospitals Al Sader General Teaching n the province of Al-Najaf al-Ashraf.

2.1. Study Design:

The samples tested were (50) samples, which divided into the patient group were (30) samples, and the control group (20). The sample of adults for both sexes aged 38 to 89 y years (with inclusion/exclusion criteria) was collected on a daily basis throughout the study period.

2.2. Collection of Blood Sample:

Using five milliliters of sterilizing collaborations, specimens of blood were taken into veins. Specimen placed inside container with label. The blood was given the opportunity to coagulate for ten minutes at the ambient temperature and and subsequently centrifuged lasting fifteen minutes at 6000 rpm. The blood serum was subsequently divided and frozen below eighty ºC unless the investigation's laboratory examination could be completed.

2.3. Biochemical parameters

2.3.1. Determination of Electrolyte test

Plasma colorimetric process has been used to ascertain the serum's quantity of [chlorine, Na ,calcium, and Potassium]. The sodium and potassium content of the sample had been supplied by Biolabo SA, France.

2.3.2. GFAP

Plasma colorimetric process has been used to ascertain the serum's quantity of [chlorine, Na ,Using a type of enzyme-linked immunosorbent assay (ELISA) prepared at SUNLONG, China (Cat-No. SL0759), the quantities of the GFAP in the blood samples were measured.

2.4. Statistical Analysis:

The SPSS software was employed for statistically evaluating the data (SPSS, Version 26). The test for significance was employed, or descriptive calculations of averages or the standard deviation were performed comparing patients alongside the control subgroups. To determine the correlation among marker and factors, Pearson correlation coefficients were calculated. The data visualizations were created with the Microsoft Office 2016's EXELL implementation. Every one of these variables was statistically tested at $P<0.05$ significance.

3. RESULTS:

3.1. Demographic Characteristics of study subject

. A combined total of fifty cases, comprising Twenty standards and Thirty Alzheimer's patients, were investigated in the present investigation. According to the table (1), The individuals receiving treatment ranged in range from aged 38 to eighty-nine years old. The exact same table indicates that, in contrast to the untreated group, the BMI of these individuals has significantly increased to 27.79± 1.86. It has been demonstrated in this investigation that there is a higher proportion diversity among men than women. Additionally, the results showed that eighty percent of the respondents had high blood pressure, forty per cent had diabetes, while approximately 30 percent of participants were smokers within people with Alzheimer's.

Table 1: Comparison of the clinical characteristics between Patients with Alzheimer disease and control groups

Clinical characteristics	Mean ± SE	
	Patient N=30	Control N=20
Age (year)	69.50± 4.37 *	27.20± 1.93
BMI (kg/m2) Normal weight Overweight obese	27.79± 1.86 * (50 %) (10 %) (40 %)	20.40± 1.12
gender	Male (70 %) Female (30 %)	Male (50 %) Female (50 %)
Hypertension	Yes (80%) No (20 %)	No (100%)
Diabetic	Yes (40%) No (60 %)	No (100%)
Smoking	Yes (30%) No (70 %)	No (100%)

3.2. Electrolytes Concentration of study subject

The figure (1, 2, 3) shown the specific electrolytes test levels between the studied groups. According to these figures there was a non-significant increase ($p< 0.05$) in sodium (Na), significant increase of potassium (K) level and significant decrease of calcium (Ca) in patients with Alzheimer disease comparison with healthy group.

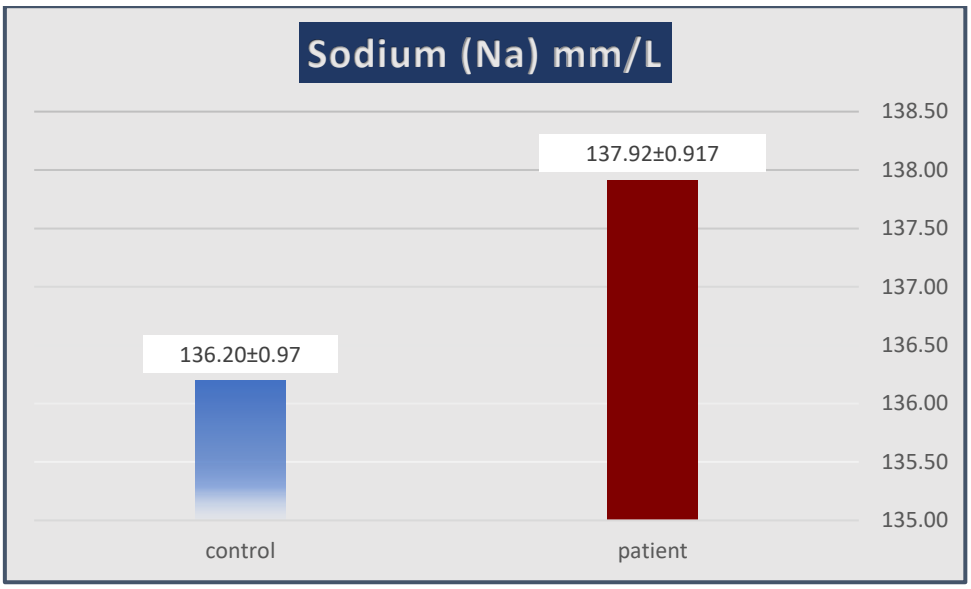

Figure 1: Comparison of the sodium between groups of Alzheimer disease and healthy group

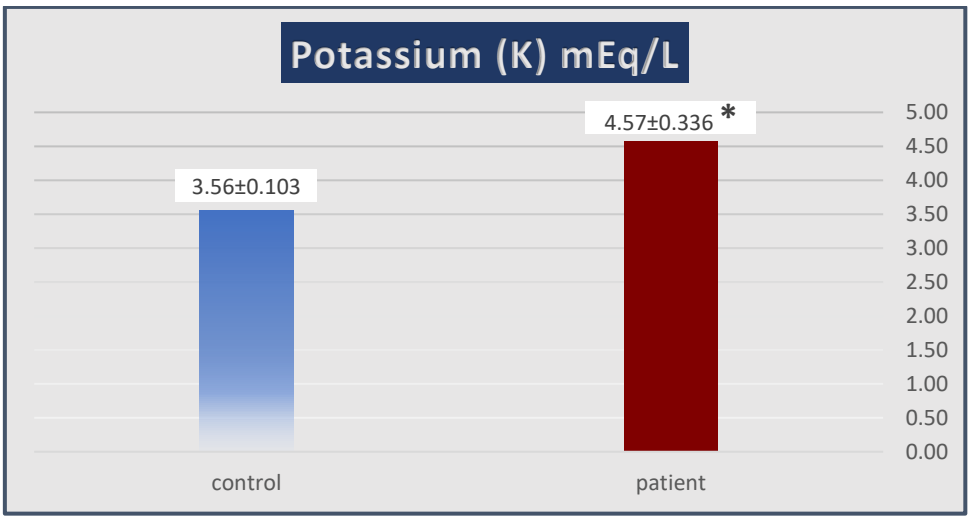

Figure 2: Comparison of the potassium between groups of Alzheimer disease and healthy group * P< 0.05 statistically significant with control group

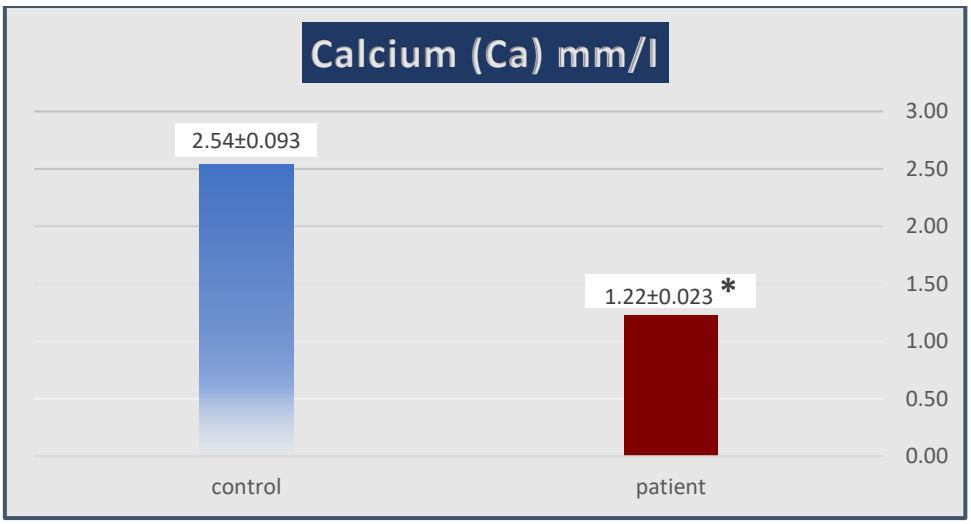

Figure 3: Comparison of the calcium between groups of Alzheimer disease and healthy group

3.3. GFAP concentration

The figure (4) shown the specific biomarker test levels between the studied groups According to this figure there was a significant increase ($p< 0.05$) of GFAP level in patients with Alzheimer disease comparison with other study groups.

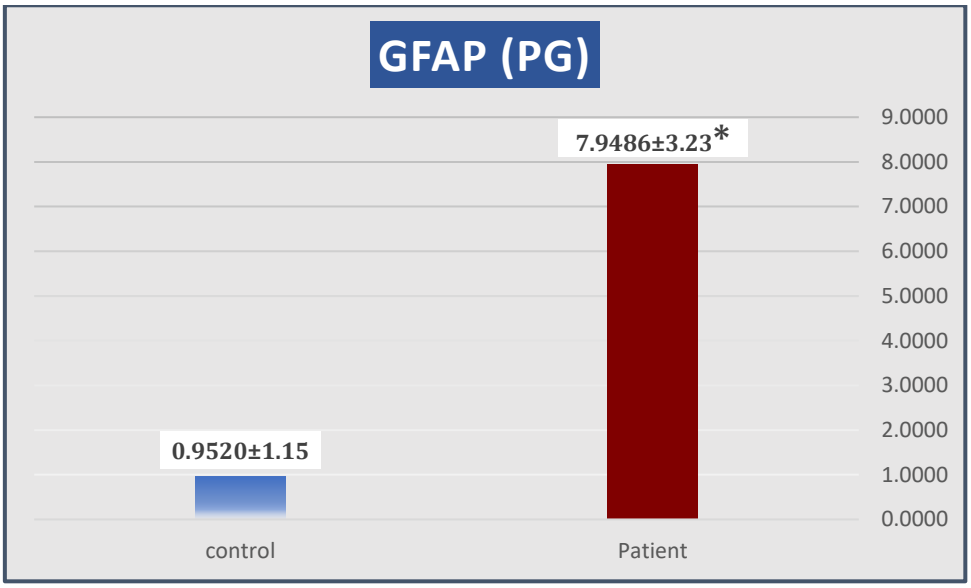

Figure 4: Comparison of the GFAP between groups of Alzheimer disease and healthy group

*** P< 0.05 statistically significant with control group**

3.4. Correlation

Table 2 presents the results of the association and linear regression among the Alzheimer's patients. It shows a substantial negative connection for the sufferers' S.CA with GFAP. However, another finding from the identical tables showed that there was definitely no significant relationship between GFAP, which and both (NA and potassium) that are part of those suffering from Alzheimer's.

Table 2: Correlation between the clinical characteristics and patients with Alzheimer disease

	Correlations	age	BMI	NA	K	CA
GFAP	Pearson Correlation	0.203	0.685	-0.030	0.143	-.911*
	Sig. (2-tailed)	0.699	0.133	0.954	0.787	0.012

*** Correlation is significant at the 0.05 level (2-tailed).**

4. DISCUSION

When analyzing the brain tissue of his very first cautious, who had trouble remembering and an alteration of behavior beforehand to death, Dementia discovered the existence of amyloid plaques and an important degeneration of neurons. He defined the illness as a horrible condition of the cerebral cortex. In his psychiatric manual, the eighth edition, Emil Kraepelin, MD initially referred to this medical condition as Alzheimer's dementia.

(6,7).

Furthermore demonstrated by our research These results were in line with the theory that one of the main risk factors for AD is age (8). The prevalence of AD rises with age, reaching an estimated 19%

in those 75–84 year old (9) and thirty to thirty-five and potentially even 50%, in people who are over 85 years old (10). Therefore, in the cognitively healthy brain, as one ages, the volume and weight of the brain decrease, the ventricles continue to grow, and certain parts of the brain experience an absence of neurotransmitters and dendrites and which is followed with SP and new financial technology (11).

AD may be caused by two additional age-related pathogenic processes. The first is the deterioration of myelin, which leads to the disintegration of white matter fiber tracts (12). However, some research indicates that myelin loss happens later in the disease as a result of neuronal degeneration (13). Second, there is cell loss in brain stem nuclei like the locus coeruleus (LC), which encourages microglia to inhibit the synthesis of AD and sends noradrenaline via terminal varicosities to the cortex. (14).

During the present research, sufferers' BMIs (27.79±1.86) are significantly higher than controls'. The present research confirms a prior study's contentious finding that obesity is a particular cause for Alzheimer. Just consuming alcohol increased the likelihood to experience cognitive decline out among the Fourteen variables linked to dementia in a significant proportion of patients; obesity, depressive disorders, and elevated cholesterol levels were more probable to be statistically connected to a reduced Alzheimer's disease probability. (15).

The investigation additionally discovered neither neither the beginning of AD nor its advancement was linked to numerous among the conventional warning signs of the condition. On the other hand, a high correlation has been shown among overweight and the onset of AD, indicating how changes in metabolism linked to weight harm the immune system and cause brain cells to die by necrosis, or apoptosis, by changing neurological adaptability. (16).

An earlier study confirmed that obesity has been regularly linked to Alzheimer's disease, having a greater midlife body mass index (BMI) correspondingly raising the chance of AD (17). Given the pivotal function which insulin plays as a neuromodulator (18), the link between diabetic with Alzheimer (19) is not unexpected. First, a condition called hyper insulin resistance, and Alzheimer's disease are related. Resistance to insulin leads to the accumulation of SP, which can be the source of elevated insulin levels (20).

Secondly, this is a link between alzheimer and type 2 (T2) type 2 diabetes, as well as its antecedents, high insulin levels and obesity (21). Third, there was substantial brain shrinkage, cerebral decreasing, or increased protease levels in transgenic mice with severe hyperinsulinemia (22). Finally, there was also a greater deterioration in memory retention in mice given a fatty diet that included cholesterol during the investigation (23). 5th, the sortition group of cardiovascular proteins separating-10 domains (VpS10) proteins contains genes linked to hyperglycemia with Alzheimer in diabetic. (24).

Additionally, the outcome showed the eighty percent percentage breakdown of hypotension in the Ad research individual. The most recent research concurs previous Kivipelto et al. (2001), which examined high blood pressure as a possible predictor for the onset of Alzheimer's disease (25). Gender is the main non-modifiable predictor for AD development. As people years of age, a number of cardiovascular hazards rise, such as blood pressure (the petroleum company), that may have an impact on the processes that cause damage to the brain (26).

People who have elevated blood pressure generally have a 25% incidence rate, with more than fifty percent of those over 60 (27). Arterial risk variables, such as blood pressure, have the potential to alter the human body's structure by producing ischemia and cerebral hypoxia, altering vasculature barriers, and ultimately contributing to the progression of Alzheimer (28). In addition, high pressure may lead to a brain-blood vessel disruption, as is frequently linked to the development developing Alzheimer. (29).

Research investigating the relationships among the petroleum company with AD has produced mixed findings, either demonstrating a lack of correlation among these factors or a connection among Alzheimer's disease with elevated BP (30-32). For instance, Mielke discovered a link between a higher risk of AD and diastolic hypotension. Researchers did not discover a relationship among Alzheimer's

disease and pulmonary hypertension, but (33). According to the Hampstead II Study, higher beginning SBP was associated with lower verbal fluency at follow-up but inferior memory function at baseline, especially in women (29).

During a Swedish study with 999 participants followed for 20 years (age of BP evaluation, 50 years), higher baseline the DBP correlated with lower late-life cognitive abilities. Remarkably, in hypertension people not receiving antihypertensive drugs, the correlation appeared stronger. (34).

Electr0lytes are substances play a wide range of tasks, including altering how your brain operates. It was shown in a prior study that vigorous activity raises serum cA levels and causes the brain to receive the ca. Via a calmodulin-dependent procedure, this in turn increases cognitive manufacturing of dopamine, and elevated concentrations of dopamine govern a variety of brain activities (35). Moreover, a decrease in intellectual capacity may be lessened by include nutritional supplements in the your eating habits, as electrolyte and metabolism of brain energy are connected. (36).

An earlier investigation discovered In addition to other biochemical abnormalities, Alzheimer's disease has been linked to decreased Na+/K+ ATPase activity (39) or increased levels of reactive oxygen species (37, 38, and 39). abnormalities in Na+ and K+ are linked to the decreased Na+/K+ Exchanger concentrations seen in AD brain tissue. (40)

The results of this research demonstrated that patients' (K) levels were significantly higher than those compared to the healthier category. These results fell in line with those of Roberts et al. (2016), who discovered that AD participants had 2.6% higher serum vitamin K levels (41). greater potassium levels in the blood were linked to greater levels of Aβ42, although this relationship did not hold true in the later years, indicating indicating potassium may be linked to schizophrenia in midcentury rather than in the elderly. Research examining additional cardiovascular hazards, which include overweight (43), elevated levels of cholesterol (42), nor hypotension (42), have revealed similar trends. (44).

Our outcomes are consistent with those of Ge et al. (2022), who discovered that calcium within cells equilibrium becomes disturbed in Alzheimer's disease. The following phenomenon has been linked to various manifestations of Alzheimer's disease, including inappropriate plasticity of synaptic neurons, excessive phosphorylation of tau protein, amyloid particles β (Aβ) depositing, and a process known as (45).This widely recognized that ca is vital to human health and that it controls several processes, which includes as a process called neuronal interaction, neurotransmitters dissemination, and cell division. (46) An increasing amount of data across multiple AD models suggests a connection between the pathophysiology of AD and intracellular magnesium homeostasis disruption. The clinical symptoms of Alzheimer's disease (including death, tau protein the hyperphosphorylation, amyloid β (Aβ) accumulation, and impaired plasticity of synapses, are tightly linked to calcium. (47,48).

Earlier studies has demonstrated that Alzheimer's disease patients have altered RNA transcription of proteins associated with ca control. (52) During the first phases of AD, modifications in ca-dependent protein proteases coincide with modifications to ca regulation. (53) There are four distinct mechanisms that explain how ca affects the advancement of Alzheimer's disease: Elevated intracellular magnesium levels result in an accumulation of Aβ; (1) insufficient influx of calcium induces a calcium equilibrium disturbance, resulting in neural damage, structural necrotic cells, or malfunction;

; (3) Inside of cells calcium excess results in aberrant tau phosphorylation and blocks tau's attachment to micro tubules ultimately leading to neurofibrillary tangles;44 and (4) the equilibrium of calcium disorder results in aberrant brain plasticity of synaptic connections, that is linked to decline in cognition in individuals with AD. (54).

The results of the present study demonstrated that, as compared to the healthy group, patients had a significantly higher (GFAP) level. The results aligned with the research conducted by Kim et al. (2023), which indicated that there was a substantial difference in blood GFAP levels between those with Alzheimer's disease and the control group. In recent years, blood indicator GFAP, which generated

interest in Alzheimer's disease studies. astronomical objects, a subtype of glial cell throughout the brain, are the main source of GFAP. In the cognitive centers of those with AD, GFAP expression is noticeably enhanced compared to its minimal expression among people with no disease. Despite encouraging findings, multiple investigations examined into GFAP's possibility as an Alzheimer diagnostic.

(55) The intermediary thread polypeptide of the astrocytic cytoplasm is called GFAP, which. In the brains of people suffering from AD, GFAP production and contents are greater in the vicinity of plaques that contain A that rise in response to tau buildup (56,57). Dynamic microglia are characterized by a range of morphological and functional modifications in conditions of disease, including overexpression of molecules like GFAP. (58).

By producing inflammatory substances, inflammatory chemicals, nitric oxide (NO), reactive oxygen compounds, and stimulating a the presence of redox inequalities, astrocytes that are reactive contribute to neuroinflammatory alterations in Alzheimer's disease (59). Prior research has demonstrated that along the course of the disease, astrocytes that are responsive may appear before early clinical markers for Alzheimer's disorder (Alzheimer's), which include amyloid as well as Aβ (60, 61).

One very brain-specific enzyme includes GFAP. Normal people's bloodstream contains a tiny amount GFAP protein (62, 63). Gliosis in Alzheimer sufferers' brains is characterized both an upsurge in inflammatory astrocytes or microglia that are activated close to the locations of Aβ plaques (64, 65), and astrocyte rupture causes GFAP to easily leak out of the tissues and enter the circulatory system (66)

4. CONCLUSIONS:

• The investigation we conducted led us to a finding that an elevated body mass index or a young age are associated with a higher likelihood of memory loss.
• A reduction in levels of calcium linked to poorer bone condition in people with AD Thus, a correlation has been seen among fractures and a greater likelihood of developing Alzheimer's disease.
• The Alzheimer's disease category's GFAP concentrations are noticeably higher compared with the comparison group's. GFAP may prove to serve as a useful biomarker for the identification, prognosis, and assessment of Alzheimer development, particularly with regard to brain injury including memory loss.

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